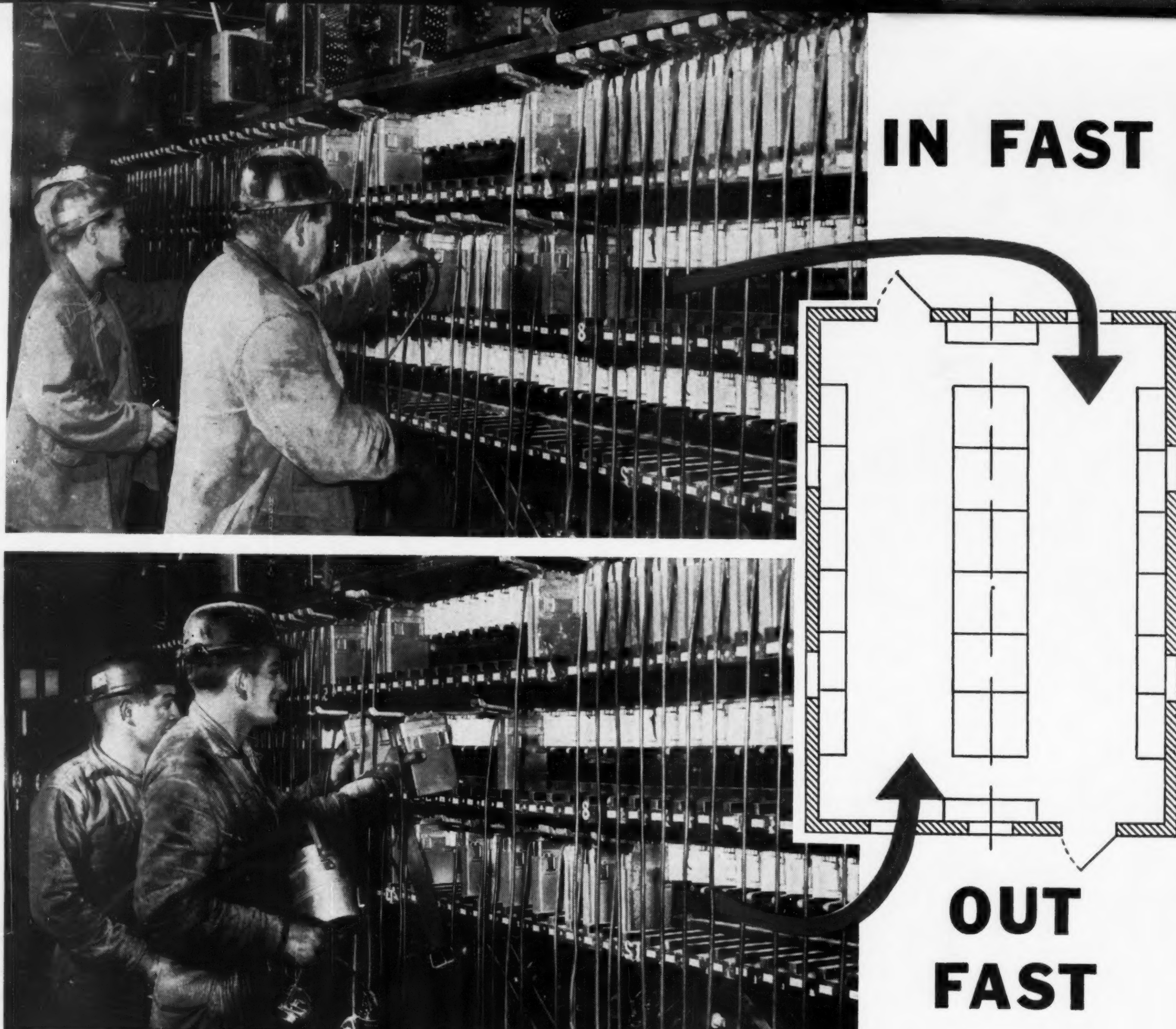
COAL MINING

October, 1955 Volume ~~31~~ 32, No. 10

Lima 2400 strips overburden at James E. Hoffman's near Karthaus, Pa.



EDISON SELF-SERVICE

The Edison Battery stays on the job

Because light is only as dependable as the battery that provides the power, battery service life is the only answer to performance. The Edison R-4 Battery does not destroy itself to function . . . does not deteriorate when not in service . . . gives you the most dependable light shift-after-shift, for years. Write for complete details.

KEEPS MINERS ON THE MOVE

One of the important advantages of our long-time experience with Edison Self-Service is the know-how it has given our Service Engineers in sizing-up a mine's lamphouse needs, then designing or modifying a lamproom layout to provide the fastest traffic flow, in and out. And the advantages of proper and efficient lamproom arrangement go beyond efficient moving of the miners—proper lamp care is easier and that means you get better, more dependable light underground. Your miners work better, safer.

You'll find it profitable to investigate Edison Self-Service. Just write or call.

MSA
SAFETY EQUIPMENT HEADQUARTERS

When you have a safety problem, M·S·A is at your service . . . our job is to help you

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Ave., Pittsburgh 8, Pa.
At Your Service: 77 Branch Offices in the United States and Mexico

MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
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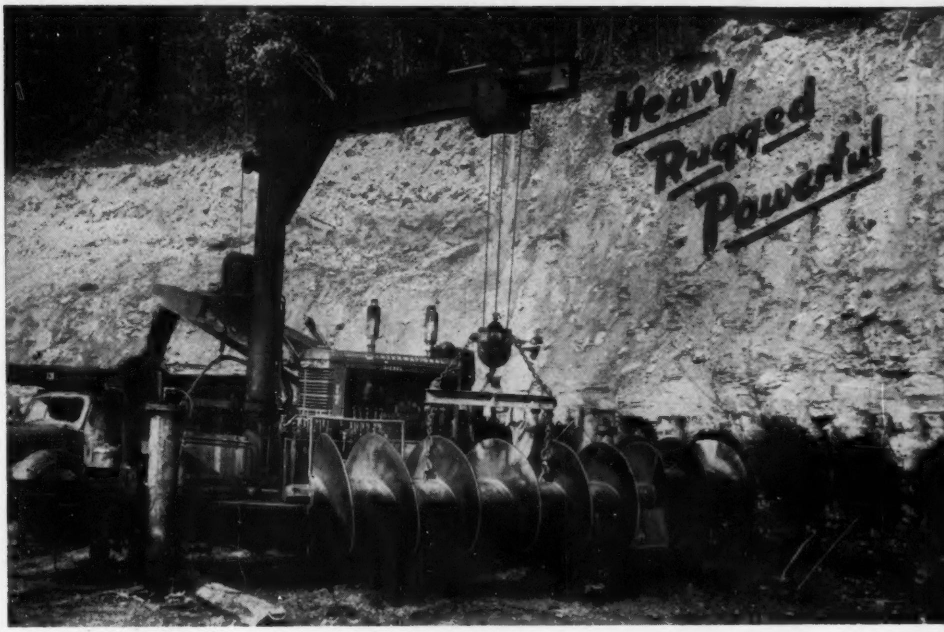
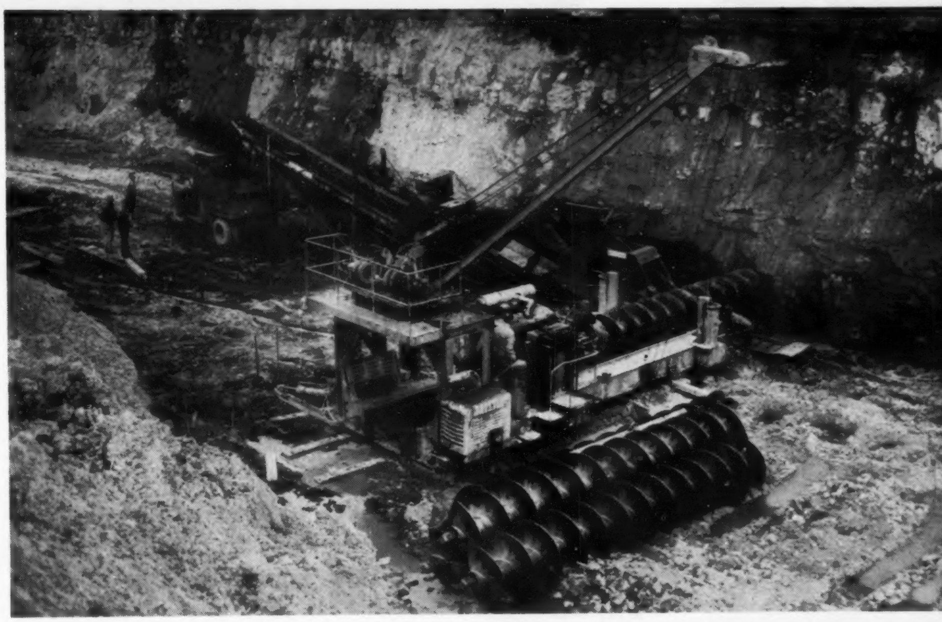


McCarthy Coal Recovery Drill, Model 1436-42, with 36" diameter augers 12' long as used by Excavators, Inc., Sommerville, W. Va.

● Robert B. Cleghorn, Jr., Hodgeville, West Virginia, reports his hydraulical, self-moving 42" McCarthy Coal Recovery Drill (shown below) mines "up to 500 tons of clean, low-cost quality coal per day." Cleghorn has a three-man crew—operates in pits as narrow as 34 feet. Operator has total vision, including the highwall. Model 12 handles 24' augers from 16" to 48" in diameter.

Hydraulically operated equipment on McCarthy Drills includes: jacks for levelling auger drill, auger guide, auger hoist, moving jacks and skids, and auger feed.



McCarthy Coal Recovery Drill, Model 1242-36, using 42" diameter augers 12' long.

McCarthy Auger Drills Lower Mining Costs

THE SALEM TOOL COMPANY

767 SOUTH ELLSWORTH AVE. • SALEM, OHIO, U. S. A.

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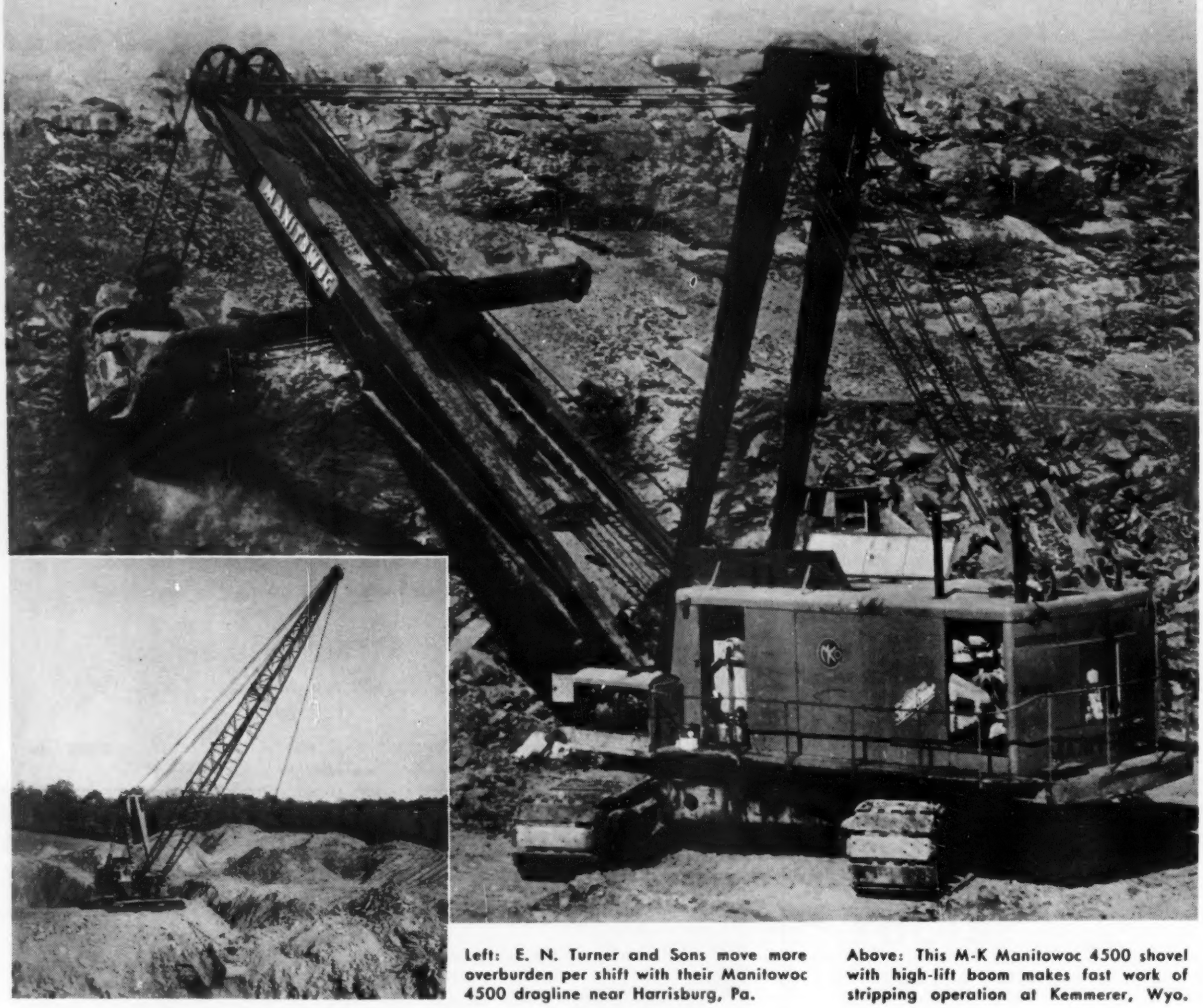
P. F. JASIK,
Publisher and Editor

Powerhouse in the Pit!



Left: E. N. Turner and Sons move more overburden per shift with their Manitowoc 4500 dragline near Harrisburg, Pa.

Above: This M-K Manitowoc 4500 shovel with high-lift boom makes fast work of stripping operation at Kemmerer, Wyo.

TORQUE CONVERTER FEATURES

- PRECISE CONTROL by either hand throttle or foot accelerator without slipping clutches or shifting speeds.
- BALANCED POWER LOAD for economy of operation — load requirements and engine horsepower automatically balanced.
- UNLIMITED SPEEDS without shifting since speeds and power are equal at all times.

MANITOWOC
SHOVELS 1-5 YD. Speedcrane CRANES 20-100 TON

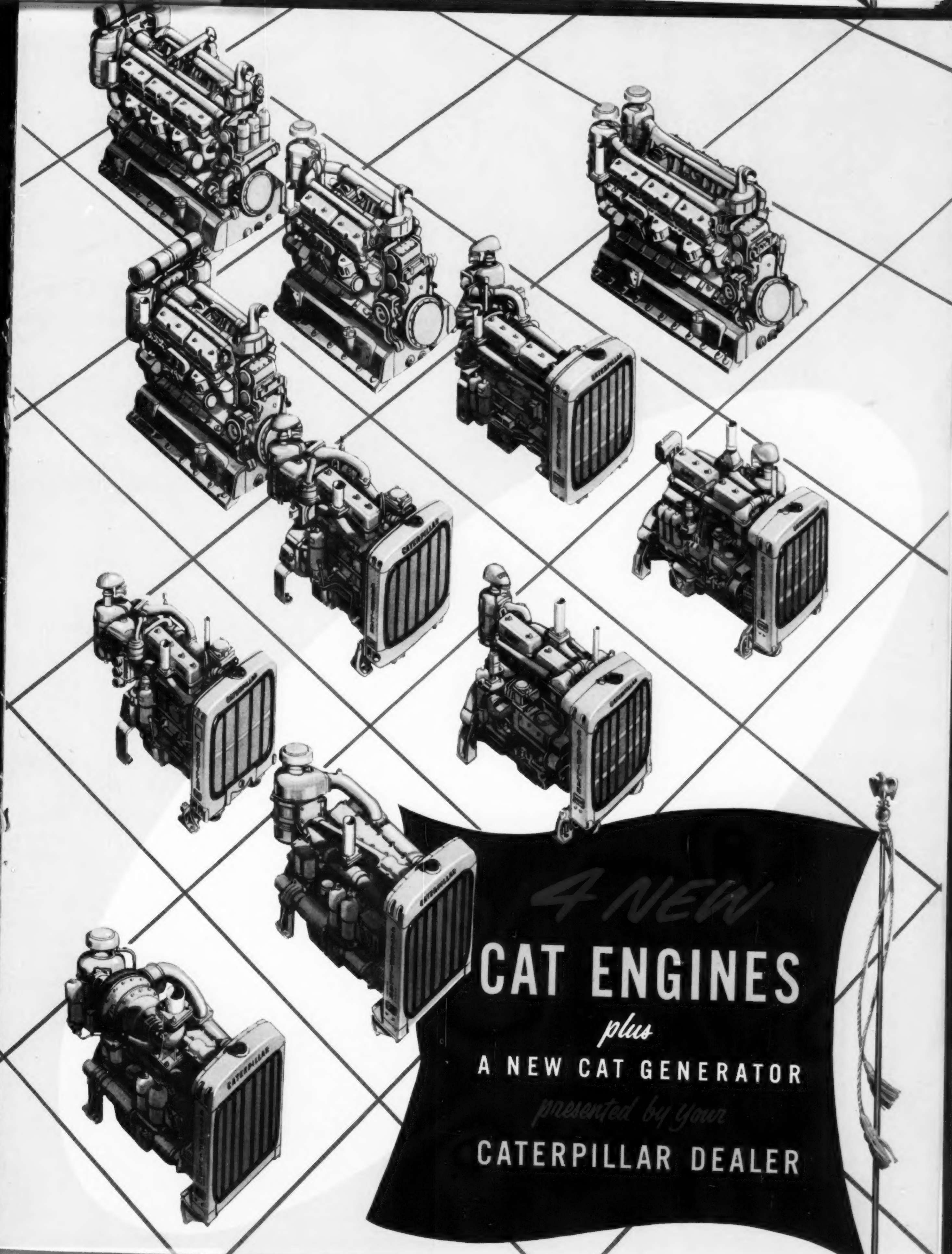
Manitowoc 4500 Loads Out Greater Tonnage for Peak Production

Manitowoc 4500 shovels and draglines are boosting stripping and loading records in every mining area of the country. These powerful 4-5½ yd. excavators boost output substantially for profit-conscious operators who require the 4500's power and stamina.

High on the list of preferred features is the 4500's ability to take rock digging shock, shift after shift, with little downtime. The extra-strength, high tensile steel shovel boom has heavy, "bridge-built" side beams; tubular dipper stick turns in the saddle to absorb all digging stress and strain; positive-action torque converter matches engine power to the load; special 60' high-lift booms extend shovel digging and dumping ranges.

Gas or diesel drive with simple gear arrangement eliminates thousands of wires and connections necessary in electrically powered machines. There's no need for cumbersome trailing cable; power loss through prime mover and D.C. generator is eliminated; entire shovel can be disassembled, moved and set up in several days instead of weeks.

Look into *all* of the 4500's outstanding advantages before investing in your next shovel or dragline. See why the speed, mobility, simplified design and versatility of these mighty mining machines are making news wherever they're in use. MANITOWOC ENGINEERING CORP., MANITOWOC, WIS.

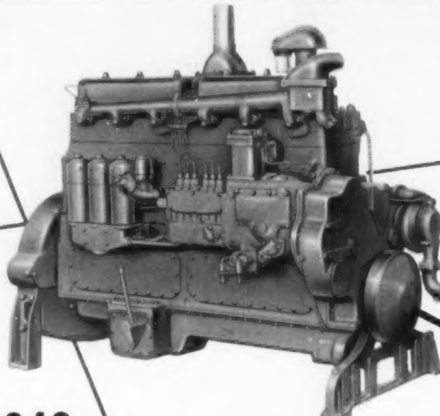

4 NEW
CAT ENGINES
plus
A NEW CAT GENERATOR
presented by your
CATERPILLAR DEALER

4 NEW

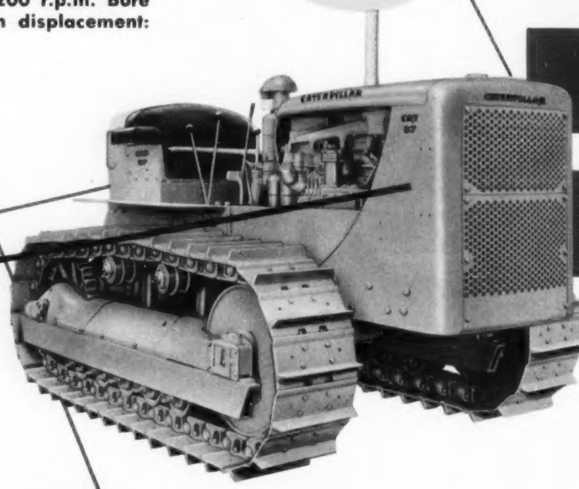
MORE POWERFUL...

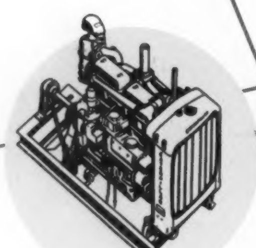
MORE COMPACT...

MORE STREAMLINED

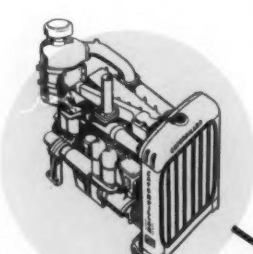


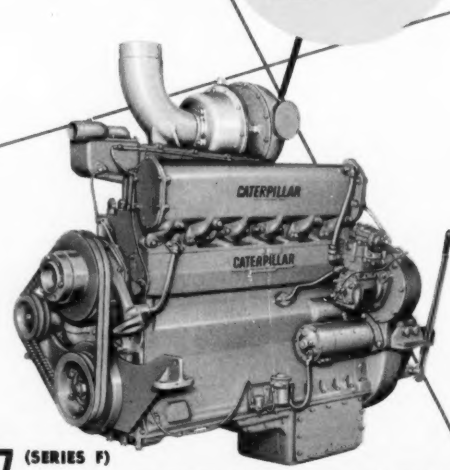
D342—the new Cat D8 Tractor which features this engine was announced recently. Since then, this tractor has been in greater demand than ever before. The D342 has an intermittent HP of 190 @ 1200 r.p.m. Bore and stroke: 5¾" x 8". Piston displacement: 1246 cu. in.

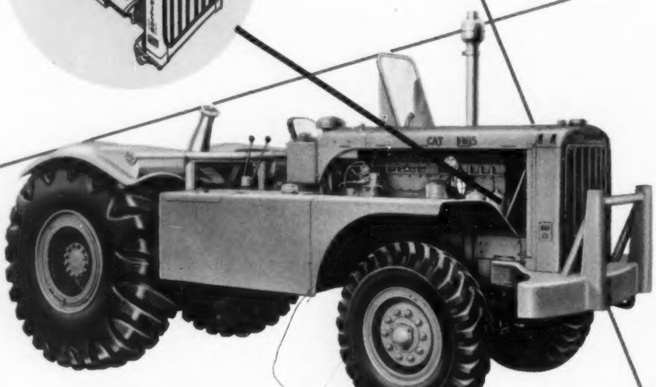




D339—was an immediate success in the new Cat D7 Tractor. New balancers give the powerful, new 4-cylinder engine "6-cylinder" smoothness. Intermittent HP: 126 @ 1200 r.p.m. Bore and stroke: 5¾" x 8". Piston displacement: 831 cu. in.







D337 (SERIES F)—the new Cat D337 (Series F) Diesel Engine, powering Caterpillar's new DW21 and DW20 Tractors, features a newly designed, exhaust gas driven, turbocharger. The turbocharger provides higher horsepower with lower specific fuel consumption. Maximum HP: 310 @ 2000 r.p.m. Bore and stroke: 5⅛" x 6½". Piston displacement: 805 cu. in.

D326 (SERIES F)—the new Cat D326 (Series F) gives owners of the new DW15 wheel tractor more power in a more compact engine block. Piston displacement has been increased over its predecessor . . . lines and tubes have been relocated inside the block. Maximum HP: 200 @ 2000 r.p.m. Bore and stroke: 5⅛" x 6½". Piston displacement: 805 cu. in.

We'll help you put this NEW power to work!

AND NOW—A NEW CAT GENERATOR

CAT ENGINES

. . . the same engines that power the earthmovers you prefer most . . . now available for your other power needs

Caterpillar—pioneer in diesel powered earthmovers since 1929, and your Caterpillar Dealer—the expert who can fit your power requirements to a "T"—announce four new diesel engines—the D342, D339, D337 and the D326! These are the same engines now powering Caterpillar's new track and wheel-type tractors.

These four new power packages bring you more work capacity in a more compact, streamlined design.

All four new engines burn low-cost No. 2 fuel oil, feature capsule-type individual fuel injection valves and new replaceable paper-type filter elements.

In addition to these new engines, your Caterpillar Dealer also introduces a new concept in electric generator performance.

It will be well worth your while to get all the latest news from your Caterpillar Dealer real soon!

ONLY CAT OFFERS YOU SUCH MULTIPLE ENGINE USE . . . SUCH INTERCHANGEABILITY OF PARTS

The chart below shows why it pays you to standardize on Cat engines all the way, particularly if you're already a Caterpillar machine owner. Notice that the same engines power more than just one piece of equipment. It means three big advantages for you: (1) parts inventories are lessened (2) operator training is simpler, faster (3) service is made easier. No other earthmoving equipment or engine manufacturer can offer you these advantages.

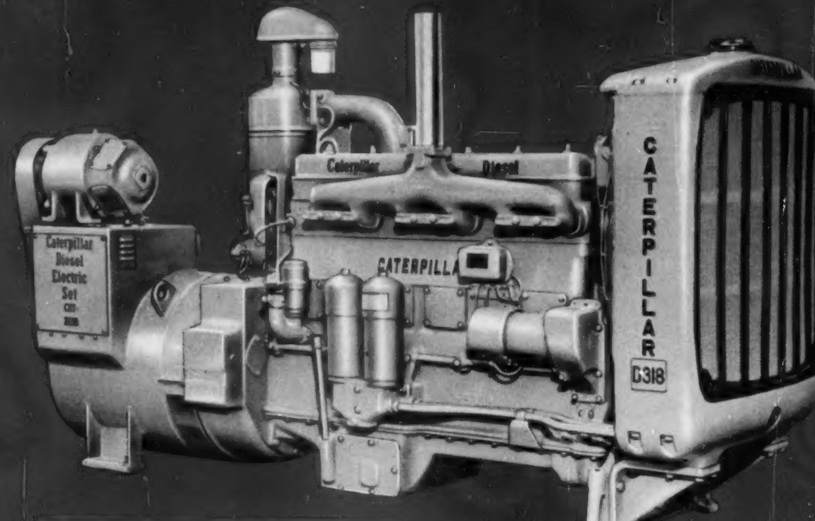
	D311	D315	D318	D326 (SERIES F)	D337 (SERIES F)	D339	D342	D364	D375	D386	D397
CAT TRACK-TYPE TRACTORS	D2	D4	D6			D7	D8				
CAT WHEEL-TYPE TRACTORS				DW15	DW20 DW21						
CAT MOTOR GRADERS	No. 212	No. 112	No. 12								
CAT-BUILT TRAXCAVATORS	No. 933	No. 955	No. 6								
CAT ELECTRIC SETS	X	X	X	X	X	X	X	X	X	X	X
EXCAVATORS	X	X	X	X	X	X	X	X	X	X	X
COMPRESSORS	X	X	X	X	X	X	X				
ROLLERS	X	X	X								
CRUSHERS	X	X	X	X	X	X	X	X	X	X	X

YOUR POWER REQUIREMENTS ARE OUR BUSINESS

Chances are that we, your Caterpillar Dealer, have on hand right now, the blueprint of your type of installation. We can say this because we've had experience in helping choose and install Cat Diesel Engines and Electric Sets for almost every type of power requirement. Be sure to see us for the solution to your power problem.

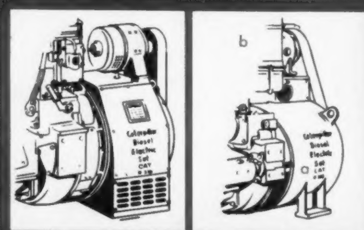
CATERPILLAR

AND NOW—A NEW SELF-REGULATED **CAT GENERATOR**

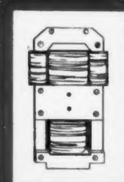


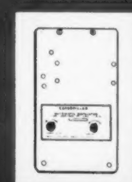
Your Caterpillar Dealer is proud to offer a new line of Caterpillar Electric Sets—with built-in features that open new fields for low-cost electric power. Featuring self-regulation with all the advantages of external regulation, these new generators have no comparison when it comes to simplicity, compactness, flexible application and rugged, long-life construction. Check these new advantages:

- **MADE FOR EACH OTHER!** Each Cat Generator is designed and built to exactly match the Cat Engine powering it. You get maximum efficiency in a simple complete package.
- **ADJUSTABLE FOR ANY CONDITION!** During initial installation, the terminal voltage and voltage "droop" can be adjusted to meet the special conditions of the application. Adjustments are locked and no further adjustments are necessary.
- **EASY INSTALLATION!** No complicated switchgear or external voltage regulators are needed.
- **VERSATILE APPLICATION!** Easily paralleled with other generators now in use.
- **BIG CAPACITY!** Motor starting ability—capacity to handle the surge of heavy loads.



These two drawings show the compactness of the new Cat Generator. Frame size has been reduced. Components are close coupled (a) and exciter (b) is mounted on top. Result: shorter over-all package length.





(Left) The "regulator" of the Caterpillar Generator. No moving parts—compact—reliable.

(Right) Adjustments are locked in the control panel at installation. No further attention required.

BECKWITH MACHINERY COMPANY

6550 HAMILTON AVENUE, PITTSBURGH, PA. • OLD TOWN ROAD, CLEARFIELD, PA. • EAST BROADWAY, FARRELL, PA.
361-369 CONGRESS ST., BRADFORD, PA. • 1356 E. 12TH ST., ERIE, PA. • BUCKHANNON PIKE, CLARKSBURG, W. VA.

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WALKER MACHINERY CO.

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CM-5

MORE EXAMPLES OF **CATERPILLAR** LEADERSHIP IN ACTION

P1055A

Do You Know?

• High school boys who are looking forward to a career in engineering should study mechanical drawing in high school, and play around after school tinkering with a hot rod or have other mechanical hobbies. It would be useful, too, to get a part-time or summer job at some mechanical work. This can help them to score higher on the spatial visualization aptitude test for entrance to engineering school.

That such hobbies and occupations will help boost the engineering aptitude test score is revealed by a study conducted by Drs. Mary F. Blade and Walter S. Watson of the Cooper Union in New York, N. Y.

High scores on the spatial visualization test do indicate an aptitude for engineering study, their research showed. But low scores do not necessarily indicate lack of aptitude. They may reflect a lack of related experience.

The psychologists studied scores on repeated testing of the same students before and after their freshman year of study. Students included 593 cadets at West Point, 114 engineering freshmen at the University of Wisconsin and 89 engineering students at Cooper Union.

In addition, the Cooper Union students were tested again at graduation. And a group of 124 non-engineering students at Wisconsin took the tests.

The spatial visualization test is a good predictor of graduation from engineering school, the psychologists found. It is a better indicator of success than is mathematical ability. But a combination score of mathematics and spatial visualization is better than either taken alone.

After a year of engineering training, the students had higher scores on the spatial test. Their gain was much more than the gain of non-engineering students.

The psychologists have some practical advice for engineering teachers as a result of their research.

It would be a good idea to postpone giving the spatial aptitude test until the end of a year of general studies, including engineering drawing and descriptive geometry, because by that time the test would be a better predictor of success. In the meantime teachers of drawing and descriptive geometry might use a different instruction method for those with undeveloped spatial visualization due to lack of experience.

Such students might be given more use of solid models, construction and manipulation, while those with better spatial visualization worked with theoretical problems.

Details of the research are reported in Psychological Monographs.

Here and There in the Coal Industry

Ellwood B. Nelson

N. T. Camicia

The appointment of Elwood B. Nelson as general manager of the coal mining division of United States Steel Corporation was announced by James C. Gray, vice president in charge of coal operations. Mr. Nelson, who is chief engineer of raw materials of U. S. Steel's Tennessee Coal and Iron Division, assumes this newly created post October 1.

Mr. Nelson is a veteran of 26 years service with U. S. Steel's TCI Division, serving successively as coal washer engineer, washer superintendent, mine superintendent, assistant general superintendent and general superintendent of the Division's coal mines. On October 10 of last year he became chief engineer for raw materials, his position at the time of his present appointment.

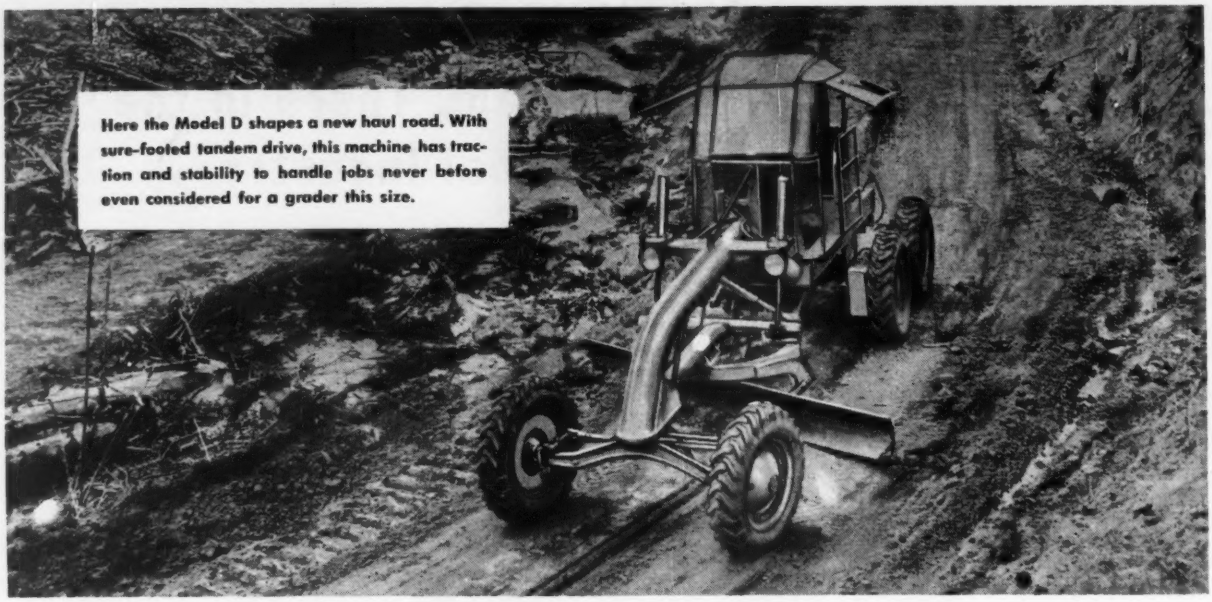
On August 29, 1955 Charles E. Beachley, secretary-treasurer of Pittsburgh Consolidation Coal Company since its formation in 1945 and associated with one of its predecessor companies since 1916, died in West Penn Hospital, Pittsburgh, Pa.

In line with the merger of Pond Creek Pocahontas Company into Island Creek Coal Company, Mr. James L. Hamilton Vice President of Operations of Island Creek Coal Company, has announced a number of organizational changes.

Nicholas T. Camicia, formerly General Manager of Pond Creek Pocahontas Company has been appointed General Manager of Mines with headquarters in Holden, West Virginia. Mr. Camicia's new assignment includes responsibility for all plants and coal production, and he will coordinate line and staff functions concerned with day-to-day operations.

Mr. Hubert H. Barber, formerly General Manager Island Creek, has been appointed Assistant to the Vice President of Operations for Labor and Public Relations.

He will also be given special assignments in connection with expansion activities as deemed advisable by the Vice President—Operations. Following such acquisitions, he will assist in the policy coordinations of such operations with Island Creek Coal Company practices.



Here the Model D shapes a new haul road. With sure-footed tandem drive, this machine has traction and stability to handle jobs never before even considered for a grader this size.

Graded Haul Roads Increase Your Earnings

HAUL roads shaped and maintained with your own motor grader help step up output and cut costs on logging operations. Here's why:

1 Grader-maintained roads are smoother, better contoured—permit hauling units to make more trips per day.

2 Frequent grading eliminates ruts and potholes, cuts costly wear and strains on trucks.

3 Operations can proceed on schedule *in any weather* —graded roads drain fast, dry quickly.

And you get all these advantages . . . at the lowest possible cost with the Allis-Chalmers Model D.

First, it is built for the job, with all the features of a big grader — tandem drive, power hydraulic controls, fully visible blade, high-arch front axle, optional leaning front wheels, and power circle turn — yet costs only 1/3 as much as the large machines. It has the power, traction and balance to keep roads in really serviceable condition at far less cost than bigger, more expensive equipment.

The Model D is economical to own and operate — runs all day on a tank of gas. Even an inexperienced person can learn to run this machine in a surprisingly short time.

The Model D is available with a choice of gasoline or diesel engines. A full range of accessories include rear-end loader, scarifier, windrow eliminator, all-view cab, heavy-duty front tires, blade and V-type snowplows.

Write now for free catalog or see your Allis-Chalmers dealer for a demonstration.

CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS A-C

WEIGHT: 8,800 lb.
BRAKE HP: 50

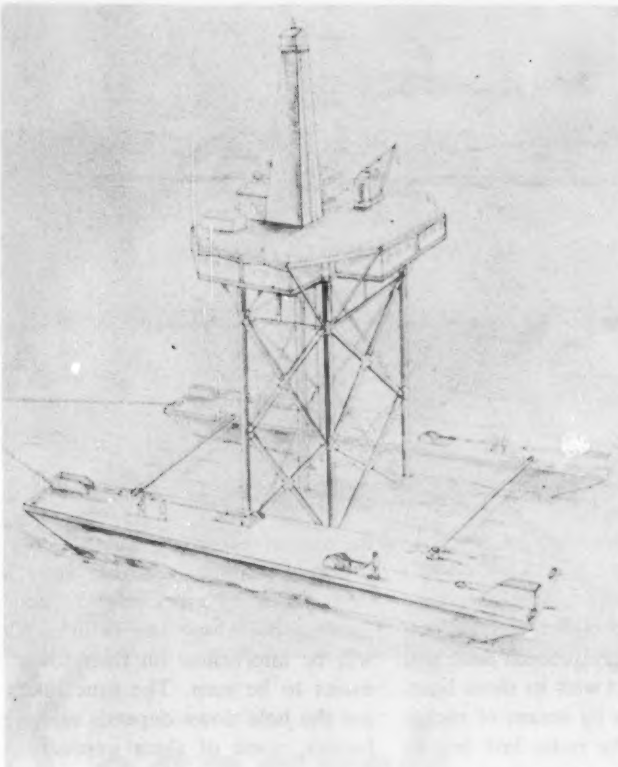
SPEEDS: Four forward to 25.6 mph
Reverse to 3.3 mph

Here the Model D loads gravel from a hillside bed . . .

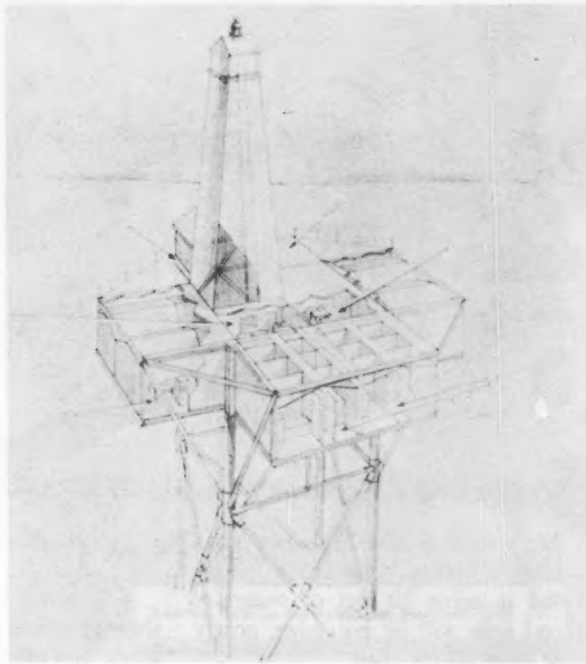
and carries it out to a soft spot in the haul road. This rear-mounted hydraulic shovel with 5/8-yd bucket loads dirt, stockpiles bulk material, etc.

BORING FOR COAL BENEATH THE SEA

Prize Of 6,000,000,000 Tons May Be At Stake In Unique Project Off Scotland



The Tower being towed out to sea.



KEY

A. SLEEPING QUARTERS & RADIO ROOM
B. FIRST AID ROOM
C. GENERATOR ROOM
D. GALLEY & MESS
E. BOREMASTER'S QUARTERS STORES & OFFICE
F. RECREATION ROOM

The Tower in its working position.

by Alex Conner
Scottish Author

A start has been made on one of the most spectacular mineral boring operations ever undertaken in Britain. A steel tower, built after the fashion of a coastal fort, has been anchored in the Firth of Forth, East coast of Scotland, a mile-and-a-quarter off-shore from Kirkcaldy. Operating from a working platform about 50 feet above sea level, at high tide, drilling experts will bore down nearly 2,000 feet and bring up cores of the strata to assist the National Coal Board in its planning program for the new Seafield colliery.

The overall aim is to prove that this under-sea area contains the largest remaining virgin field of coal in the United Kingdom.

6,000,000,000 Tons of Coal

In a way there is a "heads I win, tails you lose" touch about the project. It would be almost impossible to find any mining engineer or geologist who would be prepared to assert that the coal seams are not continuous all the way across the Forth from Fife to the Lothians, but what is not known is the true picture of the levels and the actual depths and thickness of the seams, and that is essential for forward planning of high output collieries involving expenditure of up to £10,000,00 ($28,-000,00) per unit.

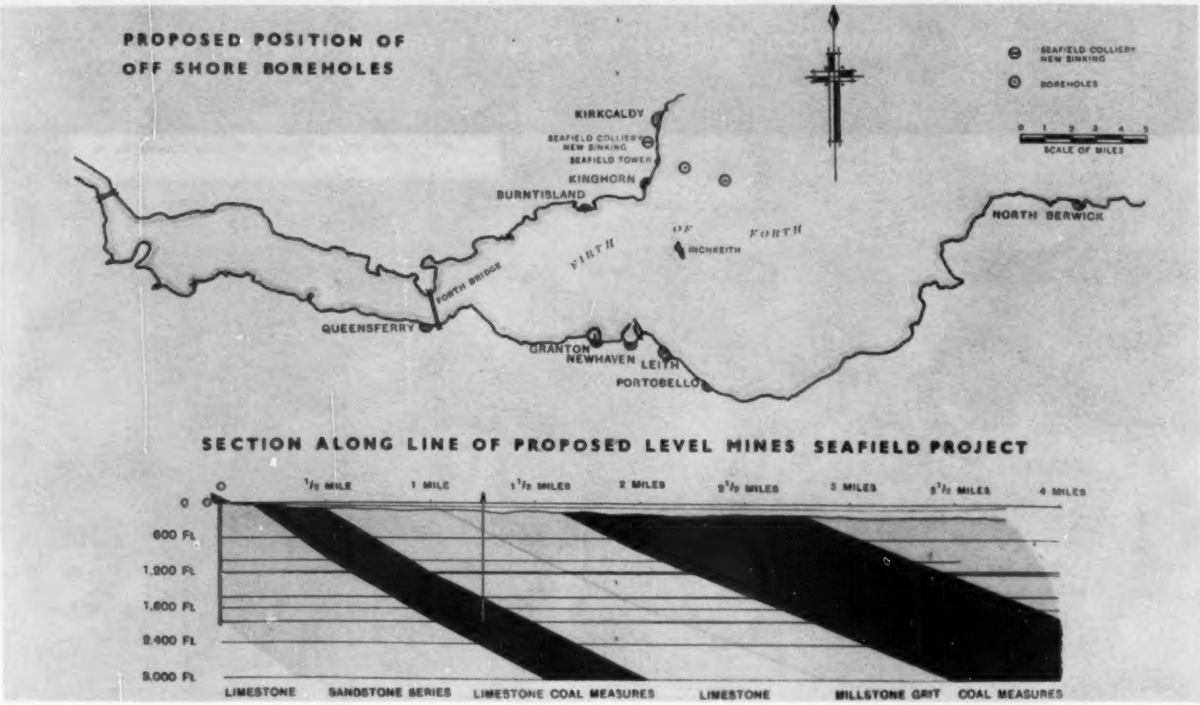
The prize which the Coal Board is after in this under-sea field, the first of several similar areas to be bored, is, according to Mr. H. R. King, Production Director of the Scottish Divisional Board, 6,000,000,000 tons of coal.

Reducing that to understandable terms it means 6,000 years output for the largest colliery in the Scottish coalfield or, put another way, the equivalent of 250 years production for every colliery in Scotland.

The cost of the tower is £250,000 ($700,00). Although it is being used initially in the Firth of Forth, the structure is a national project and, if successful in Scotland, similar work will be undertaken off the coast of Durham in Northern England and elsewhere.

Virtual Prisoners

The mining picture in the Firth district at present is that collieries on either shore are working seawards in the direction of the center of what is thought to be a vast basin-shaped field.



The bore hole now being put down to bring up cores of the strata will be drilled in some 70 feet of water. A second hole will be put down nearly three miles off the coast.

The team operating the rig will be virtual prisoners for days, and perhaps weeks on end. The tower was designed by engineers who were responsible for establishing nearly 50 sea forts during the war, some of them 30 miles out to sea.

It is floated to its drilling position and lowered on to the sea bottom. The legs, of tubular steel, are fixed to a base of cruciform design. The whole structure, therefore, rests evenly on the sea-bed.

Can Withstand Gales

Preliminary investigation and examination of the bottom were carried through with the aid of the latest scientific instruments and by visual inspection by divers. When lowered into position, the tower is capable of withstanding an 80 mile an hour gale and waves measuring 30 feet from crest to trough.

The "X" shaped girder base consists of two heavy steel box sections 163 feet long. The working deck, 50 feet above the water level, carries a drilling rig which rises a further 54 feet into the air.

The tower, in effect, is a stationary ship. It carries fog signals, recognition lights, and other navigational aids, and it has radio contact with its shore base. Emergency signals by means of rocket can be made if the radio link breaks down. A life-boat is standard equipment and a motor boat has a full time job running between the tower and the shore with provisions, stores, mail and, as a liberty boat.

Comforts for Crew

The total weight of the tower is almost 500 tons. The working deck serves also as the crew's residential quarters.

The tower, in fact, is a minature township. It has no post office but a regular postal service (weather permitting); no movie but television; no railway station or pier but a ferry service to the mainland (again weather permitting); no ordinary telephonic communication with the outside, but radio contact.

Until the contract is completed the drilling teams will work, eat and sleep on their windy perch above the cold and often angry waters of the Forth. In the winter months especially it will be one of the most isolated jobs in Scotland although, as the crow flies, only a mere 14 miles from Edinburgh. Exactly how long the drilling teams will be imprisoned on their tower remains to be seen. The time taken to put the hole down depends on several factors, some of them unpredictable. For example, some bores put down on land to more or less comparable depths have taken up to two years. On the other hand, one hole which went 3,600 feet was completed in nine months.

Everything possible has been done to make the crew's "residence" on the tower comfortable. The 16 men have been provided with individual cabins with hot and cold water. Heating is by electricity generated by three diesels, and the little township will be completely self-sufficient even in the matter of water because a seawater distillation plant has been provided. The men will work in 12 hour shifts and, since shore leave is likely to be difficult to arrange on occasion, wages will be high.

Nothing has so caught the imagination of mining men for years as this Firth of Forth project which is being conducted along with the development of the new Seafield colliery on the shore.

For pamphlet "Drilling for Coal at Sea" write National Coal Board, Hobart House, London W. I, England.

Another belt in operation at Peabody Coal Co.

Research TO DEVELOP STANDARDS FOR FIRE - RESISTANT CONVEYOR BELTS . . .

By S. P. Polack

INTRODUCTION

Any coal-mine fire is a potential disaster with many paths to travel toward a goal of death and destruction.

Such fire can cause a widespread explosion, roof falls, and asphyxiation of all in the path of the smoke and poisonous gases that are the normal results of such a catastrophe.

A conveyor-belt fire is the most dangerous of mine fires, especially when the belt is combustible. The length of the belt furnishes a clear, unobstructed path for rapid travel of the flame in its relentless search for victims.

The disaster at the Cresswell Colliery in England, where 80 persons lost their lives as a result of a conveyor-belt fire, focused the spotlight of attention on this hazard to coal miners. An analysis disclosed that over 50 belt fires have occurred in coal mines in the United States during the few years that conveyor belts have been in use to any noticeable extent.

The total loss of life in American coal-mine-conveyor fires was not nearly as great as the loss at Cresswell; however, 4 lives were lost in 1 of the fires, and the probability of greater loss of life cannot be overlooked.

1/Presented at 45th Annual Convention, Mine Inspectors' Institute of America, Springfield, Illinois, July 13, 1955.

2/Health and Safety Engineer, Bureau of Mines, Pittsburgh, Pa., and Chairman, Underground Conveyor-Belt Fire-Prevention Research Committee.

The Federal Mine Safety Code refers to "fire-resistant" conveyor belts for underground use, but as yet no means of measuring such resistance is available.

The Director of the United States Bureau of Mines presided at a meeting in July 1954 attended by representatives of coal operators' organizations, United Mine Workers of America, Rubber Manufacturers Association, State mining departments, and members of his staff to discuss the belt-fire

Entry belt at C. W. & F. Coal Co.

hazard and suggest remedial action. A research committee was selected and given the following assignments:

1. To determine what qualities a conveyor belt must have to be classed as "fire-resistant."[3]

2. To prepare a schedule whereby conveyor belts would be tested for approval and acceptance as fire-resistant.

Research and Development

The necessary research for the first phase was divided into two parts:

(a) Reaction of conveyor belts to applied flame and friction.

(b) Thermal decomposition of conveyor belting at temperatures below ignition (200° to 300° C.)

After making a thorough search of available technical literature, it was found that the research by the British National Coal Board, Du Pont laboratories, the Rubber Manufacturers Association, and German, French, and Netherlands laboratories was illuminating and helpful on the subject of flame tests. The British also had specifications for a drum-friction test.

3/Definition from Webster's New International Dictionary: "Fire resistance: Degree of resistance (of material) to fire. Where determined quantitatively it is measured in terms of time of withstanding a standard test fire."

Finally an American test for fire resistance that appeared adaptable for testing conveyor belting was selected from Standards of the American Society for Testing Materials (ASTM)

Flammability of Plastics Over 0.050 Inch Thick, ASTM Designation D635-44

When the data on flame tests by the ASTM D635-44 method were evaluated and compared with the results of flame tests by some of the methods referred to in the previously mentioned publications, using specimens cut from the same samples, it was disclosed that some belts were fire-resistant when tested by the ASTM method and not fire-resistant when tested by R. M. A., English, or Du Pont methods of flame testing. Upon analysis, the outstanding differences in these methods were flame temperatures, mounting of specimens, rate of air flow during testing, and method of evaluating results. After careful consideration of all methods used and incorporation of good features from each a new flame test was devised for testing the fire resistance of conveyor belting and was designated USBM-ASTM Flame Test.

The apparatus and method of testing follow:

Four test specimens, each 6 inches long by ½ inch wide by the belt thickness, are cut from each sample of belt to be tested in such a manner that 2 of the specimens are cut parallel to the warp and the others parallel to the weft. The specimen is clamped in a support with its longitudinal axis horizontal and its transverse axis inclined at 45° to the horizontal. A 20-mesh metallic gauze about 5 inches square is clamped in a horizontal position ¼ inch below the pulley-cover side of the specimen, which extends about ½ inch beyond the gauze.

The apparatus for this test consists of a 21-inch cubical metal gallery provided with a 16-to 8½-inch standard ASME flow nozzle in one side and an 8-inch-square opening directly opposite in the other side of the gallery leading into a wind tunnel containing a fan. A streamlined air flow having a velocity of 300 feet per minute is available to pull air horizontally past the specimen. A burner placement guide is so installed in the gallery that the relative positions of the specimen and the Bunsen burner are standardized for every test and place the specimen in the exact center of the air stream.

Procedure for Flame Test

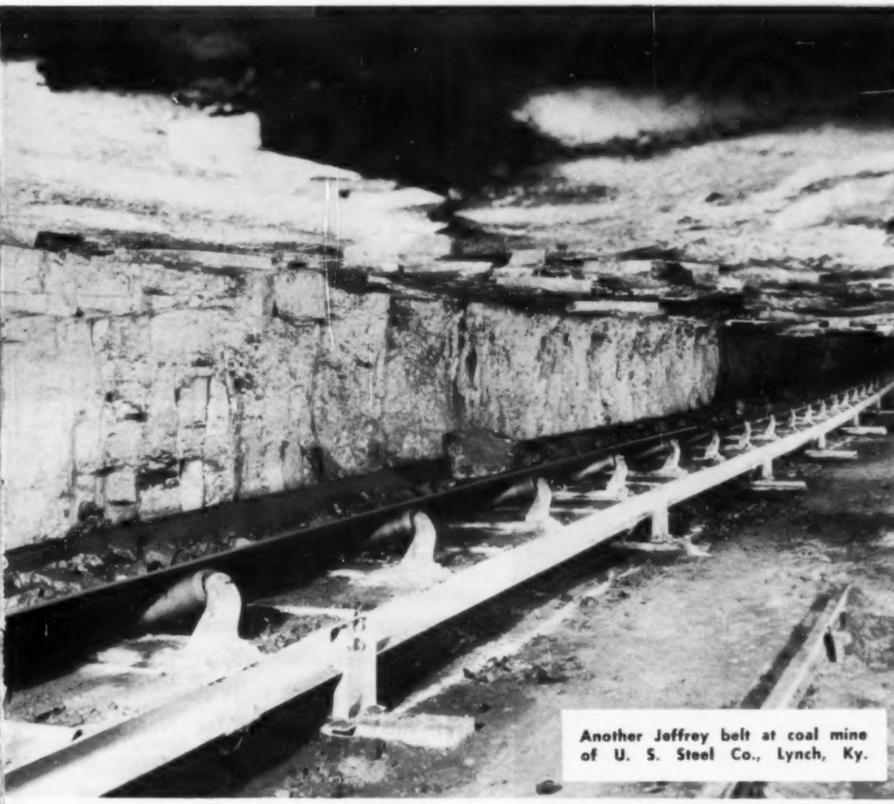
1. The support stand, with the test specimen properly positioned is placed in the gallery.

2. The Bunsen burner is adjusted to give a soft blue flame 3 inches in height having a temperature of 1350° F. $\pm$ 50° F. at a point 1 inch above the top of the burner.

3. The test specimen is so adjusted that the free end is centered in the flame at a point 1 inch above the top of the burner. The observation door in the gallery is closed.

4. The burner flame is applied to the test specimen for 1 minute with the fan in the off position. At the end of the 1-minute period, the burner flame is extinguished and the fan turned on to provide an air current having a velocity of 300 f.p.m.

5. After the test specimen ceases to propagate flame it is allowed to remain



Another Jeffrey belt at coal mine of U. S. Steel Co., Lynch, Ky.

in the air current for 3 minutes to determine the presence of afterglow, which may burst into flame.

6. The average results of 4 flame tests on specimens cut from any sample shall not show flame present 1 minute after removal of the burner flame or afterglow to exceed 3 minutes duration.

Over 500 test specimens cut from about 90 samples of conveyor belting supplied by 30 manufacturers in the United States, England, France, and Germany were tested using various methods; about 300 specimens were tested by the USBM-ASTM method just described, and the following advantages were noted:

Specimens are tested under controlled ventilated conditions. The evaluation of results is facilitated; instead of recording burning and charring rates and distances, which are difficult to measure, this method allows a reasonable time (1 minute) or belt material to sustain or extinguish flame in a moving air stream after having been exposed to a flame-ignition source.

In practice, this is sufficient for some belts to burn vigorously for lengthy periods, while others extinguish quickly, denoting fire resistance. The time allowed to permit glow to extinguish or kindle is decidedly on the side of greater safety.

The USBM Drum-Friction Test

After the establishment and testing of the USBM-ASTM Flame Test, efforts were concentrated on development of a test for conveyor belting to determine the rate and amount of heat due to friction developed in a jammed conveyor belt with the driving pulley turning. To accomplish this the possibilities of purchasing a conventional conveyor and standard conveyor belts were considered. After 'thorough inquiry, however, a typical underground conveyor, such as is used in coal mines, was procured from another Government agency; and, with the cooperation of the belt manufacturers previously mentioned, enough samples were supplied this laboratory for devising a drum-friction test.

Apparatus

The conveyor head with an 18-inch-diameter driving pulley was set up at the Bureau of Mines Experimental Mine at Bruceton, Pa. Preliminary tests revealed the best sample size for these revealed the best sample size for these tests was a piece of belt 9 inches wide by 4.5 feet long. Steel brackets were made for each end of the belt, one of which was provided with guide rods for adding more steel bars of definite weights, while the other bracket was fitted with a chain-and-hook arrangement. A 6-inch steel I-beam was secured to the floor beneath the driving pulley, and the hook from the bracket just described was fastened to the I-beam. The belt sample was then lapped over the driving pulley, and weights were attached to the other bracket. A surface contact of the belt on the drum of slightly over 180° was attained. At the two points the tangency of the belt with the drum thermo-

A Jeffrey entry belt at Peabody Coal Co.

Another Jeffrey belt at coal mine of U. S. Steel Co., Lynch, Ky.

couples were installed in the belt by inserting them between the first and second plies closest to the drum sur-surface. Another thermocouple was placed at a point midway between the first two. Temperatures of the belt during the entire test were recored by a Micromax Recorder. A ventilation current of 300 f.p.m. was directed on the drum and belt by the installation of a compressed-air line beneath the conveyor drum. When desired coal dust could be added between the belt and the moving drum by introducing measured amounts of pulverized coal dust into a power blower.

Procedure

For the preliminary tests no definite system of varying the tension by adding weights to the free end of the belt during a test was decided upon, and the duration of the tests was varied to explore the possibility of a gradual accumulation of heat within the belt. Another thermocouple was then inserted on the top of the belt to determine the rate of heat transmission through the thickness of the belt. After the preliminary data were analyzed a definite pattern for testing conveyor belts for friction was prepared. It was apparent that a 2-hour test was long enough to show the amount and rate of heat developed in a belt under the conditions of an 18-inch-diameter pulleyhead turning at 110 r.p.m. (517 f.p.m. belt speed), provided the following schedule for adding weights was followed:

Duration of test (min.)	Amount of weight added (lb.)	Total weight on free end of belt (lb.)
0	0	50
15	25	75
30	25	100
45	30	130
60	35	165
75	35	200
90	35	235
105	35	270
120	35	305

Under these conditions for a drum-friction test 38 samples were tested. Two test methods were used, method A and method B. In method A no air ventilation was supplied, and no coal dust was added through the tests. For method B 300-f.p.m. air current was supplied, and coal dust was introduced every 5 minutes. The results by both methods are shown in tables and curves for rubber, Neoprene, and PVC (polyvinylchloride).

In summary, the data show that the rubber conveyor belts used in underground installations today generate more heat from friction at a faster rate than Neoprene belts. It is evident that the Neoprene belts dissipate the heat more readily. After Neoprene belts reach the temperature range of 180°-220° C. their heating curves level off to nearly constant values in spite of increased friction by the addition of weights to the belts. Some rubber belts burst into flames, others glow red hot, and all of them break in 2 before the 2-hour test period is over. To this time Neoprene belts tested by this method did not flame or glow and generally did not break. The addition of coal dust and testing under ventilation aids the rubber belts to flame but does not affect the Neoprene belts appreciably.

Ignition Temperatures of Conveyor Belting

At the beginning of this problem a few samples of rubber, Neoprene, and PVC belting were prepared for tests to determine the ignition temperatures of these samples. A standard Bureau of Mines ignition-temperature apparatus[4] was used. Results of these tests are found in table 1. To summarize these results: The minimum spontaneous ignition temperature of rubber, Neoprene, and PVC conveyor belting in air ranged from 403° to 463° C. In an atmosphere of pure oxygen the ignition temperature range fell to the values 303° to 381° C. Cross sections of the belts were used for testing.

4/Zabetakis, M. G., Scott, G. S., and Jones, G. W., The Flammability Characteristics of the Cn-H2n-6 Aromatic Series: Bureau of Mines Rep. of Investigations 4824, 1951, 9 pp.

(Continued on Page 18)

SAFETY TRAINING

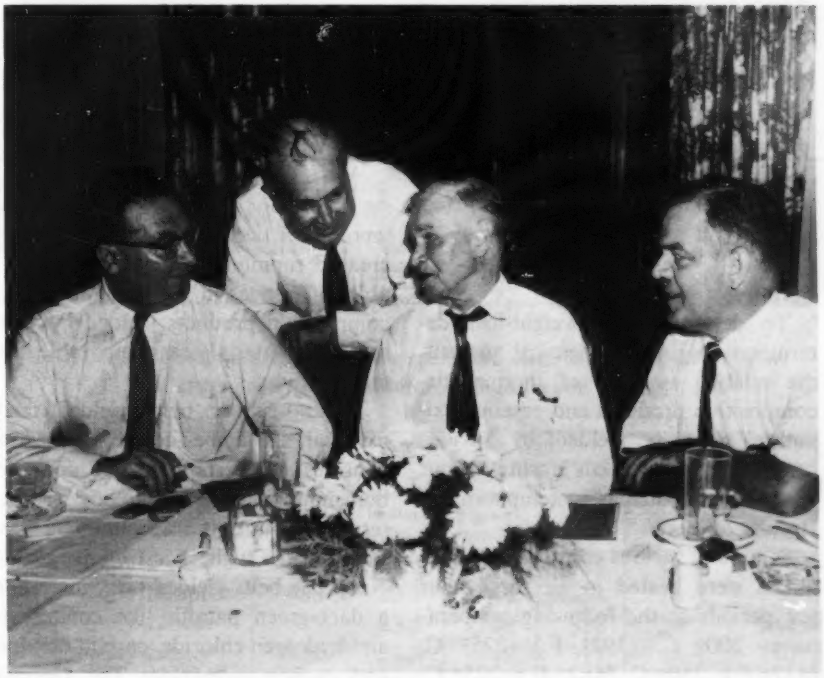
Results In Production Of Over 7,000,000 Tons Per Lost Time Accident

We are constantly acquiring new ways of thought. In the present era knowledge is growing so fast we need new ways of keeping it available. In our industry, we must welcome any new thought on coal mining. Having more knowledge at our disposal, our brain is being so modified by what we learn it is better adapted for the complex life of our time.

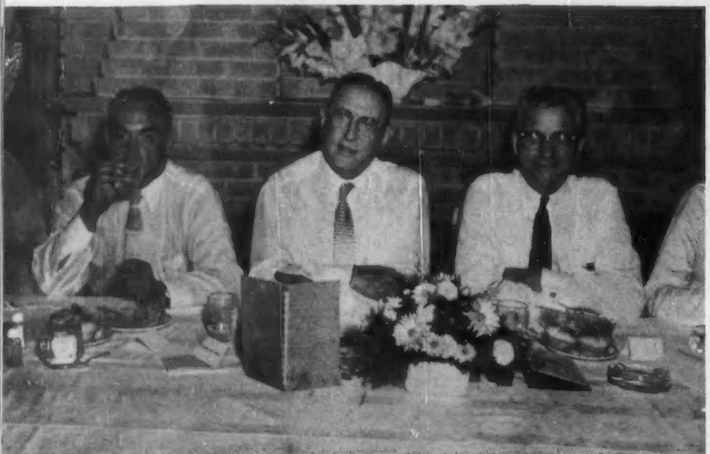
Trained minds, however, are not always welcome in an established society for they have a tendency to revolt against established standards. Trained minds advocate newer ways of doing things and are often critical of those in authority. If trained minds permitted themselves to be restrained from exercising their knowledge solving new problems, we would never have progress.

We can improve ourselves more rapidly by acquiring more knowledge. We must never cease to encourage every kind of progressive inquiry, for it is human to learn by experience and to profit from what we learn. That is what has been brought out at the presentation of honor by the Joseph A. Holmes Safety Association to the Jones & Laughlin Steel Corp. at the Nemacolin Country Club near Brownsville, Penna. June 28. It appears like it took a man from outside the industry like Admiral Ben Moreell who became Chairman of the Board of Directors for the Jones & Laughlin Steel Corp. to bring new thought into our industry, at least in public relations. It was at the instance of Admiral Moreell that all men work under safe conditions that instigated a new policy of safety training at the J & L coal mines that brought about the safety record of more than 7,000,000 tons of coal produced at the Vesta No. 4 Mine from October 11, 1951 to the present without a fatality, to set a new national record.

Overall view of gathering.



M. J. Ankenny, Safety Director, Bituminous Coal Operators Association, stops for a word of greeting to William J. Hymes, President of District No. 4, U. M. W. A. (seated, center). With them are (left) Charles Ferguson, Safety Director, U. M. W. A. and (right) Lewis G. Evans, Deputy Secretary of Mines for Pennsylvania.



H. Moses, Sec'y, bituminous Coal Operators Ass'n, left; Harry Moses, Joseph Jabloski, United Mine Workers; Admiral Ben Moreell, Chairman of the Board, and Bill Ness, Gen'l Sup't. of Mines of J. & L. Steel Corp.

Left, Earl Edwards, Retired, Superintendent and Michael Encrapera, acting for President U.M.W.A. Steve Panick and Adam Bronakoski receiving Plaque.

Left, C. L. Austin, President, J. & L. Steel Corp.; J. J. Forbes, Bureau of Mines, Wash, D. C.; A. T. Lawson, Operating V. P., J. & L. Steel, and two other J. & L. Steel officials.

Left, Dave Page, Superintendent, Tom Park, Safety Director and Dewey T. Bartram receiving diploma.

RESEARCH TO DEVELOP

(Continued from Page 16)

Purpose of Tests

To determine, by weight-loss determinations and by chemical analysis, the relative amounts of thermal decomposition products and gaseous oxidation products yielded by various conveyor-belt materials during 1-hour tests in air at increasing temperatures.

Results of Tests

Sample of various conveyor-belt materials were heated in air for 1-hour test periods at the following temperatures: 200° C. (392° F.), 225° C. (437° F.), 250° C. (482° F.), 275° C. (527° F.), and 300° C. (572° F.)

At 200° C. small amounts of decomposition products were obtained. At increasing test temperatures, the amounts of decomposition products increased rapidly. There were considerable differences in the amounts of decomposition products yielded by various belt materials at comparable test temperatures.

Natural-rubber belts yielded tarry material, an amber-colored oily condensate, and carbon dioxide and carbon monoxide. Sulfur dioxide was determined, but only trace amounts were found at the highest test temperatures. Neoprene belts yielded tarry materials, a dark-green paraffin-like condensate and hydrogen chloride, carbon dioxide, and carbon monoxide. The German Neoprene belt 71 yielded also volatile antimony compounds.

Polyvinylchloride belts yielded tarry material, hydrogen chloride, carbon dioxide and monoxide.

Test Procedure

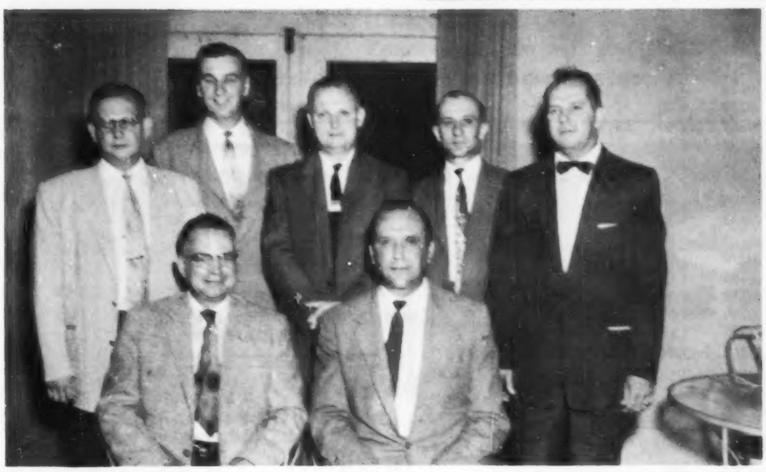
Cross-sectional test pieces of the various belt materials were cut and then equilibrated in an oven at 75° C. for 24 hours. The test pieces were stored in a desiccator over anhydrous calcium sulfate until tested. The test pieces, which were approximately ½ by ½ by ⅛ inch in size and weighed approximately 1 gram, were placed in pyrex-glass reaction tube and heated 1 hour in an electrically heated temperature-controlled furnace. During the test period carbon dioxide free dry air, at a rate of 100 ml. per minute, was aspirated through the reaction tube so as to provide oxygen and flush out volatile reaction products. Tar and

BOTTOM RIGHT—Olen S. E. Conrad and J. M. Black, State Mine Inspectors.

TOP LEFT—W. Dan Walker and S. P. Polack, Bureau of Mines, Pittsburgh, Pa.

CENTER RIGHT—In this group are H. R. Burdesky, Delbert D. Dornenburg and G. W. Chastain, M. A. Yuhase, F. D. Baker and Frank Heffers, Bureau of Mines man who conducted the Safety Courses at the J. & L. Steel Mines.

BOTTOM LEFT—In this group are Adam Bronakoski, Curtis Kerns, Raymond Barr, Albert Colantoni, Charles Remy, Steve Hegedus, Andrew Rebarick, Official at #4 Mine.



oily material were partly removed from the thermal decomposition products by means of a U-tube air condenser outside the furnace. Hydrogen chloride or sulfur dioxide was scrubbed out of the decomposition products by means of a pair of midget-impinger bubblers in series, each containing 10 ml. 3 percent hydrogen peroxide + 2 ml. N/10 nitric acid.

Finally 6,00 ml. (60 minutes x 100 ml./minute) of residual air + gaseous oxidation products were collected over a solution of 20 percent sodium sulfate in 5 percent sulfuric acid.

TABLE 1—Summary of ignition-temperature data in air and in oxygen on cross sections of underground conveyor belting

		In air			In oxygen		
Sample No.	Type material	Ignition temp., °C.	Time lag before ignition sec.	Barometric pressure, mm. Hg.	Ignition temp., °C.	Time lag before ignition, sec.	Barometric pressure mm. Hg
1	5-ply PVC	463	14.4	745	381	18.8	742
2	4-ply Neoprene	433	23.7	744	358	28.6	738
7	6-ply rubber	419	23.5	742	328	28.7	744
3	4-ply rubber	416	31.8	742	311	44.3	740
4	do	406	24.5	742	315	32.3	746
6	7-ply rubber	405	22.1	742	300	34.7	744
5	4-ply rubber	403	33.7	743	303	17.4	745

The reaction tube was weighed to obtain the belt-sample weight and the test weight loss. The U-tube air condenser was weighed to obtain the weight of the major portion of the condensable thermal decomposition products. The hydrogen peroxide sodution was analyzed for hydrogen chloride or sulfur dioxide.

The 6 liters of collected gas was analyzed by means of the Bureau of Mines modified Haldane apparatus for carbon dioxide, carbon monoxide, unconsumed oxygen, combustible gases, and nitrogen by difference to total 100 percent.

Results of numerous tests are shown in tables 2 and 3.

Research in Progress

Studies in progress at this time are effects of application of heat by radiation and contact with heated surfaces on the fire resistance of conveyor belting. A study of the actual operating temperatures of conveyors under varied conditions in several installations underground and on the surface will be undertaken as soon as the schedule for testing conveyor belts, based on the results of the research outlined, is completed. C. L. Brown, mining engineer (electrical), a member of the committee, is preparing a manuscript dealing with slippage controls and other safety devices. When all research is completed, the data will be prepared for publication.

Acknowledgments

In conclusion, I wish to express my gratitude to the other members of the committee, particularly to F. E. Scott, chemical engineer, and R. L. Beatty, chemist, who carried out much of the basic research for this problem. It is our sincere hope that our efforts, plus those of others at home and abroad, will add considerably to the measure of safety already provided for those who toil beneath the ground to make nature's wealth available to mankind.

TABLE 2.—Weight losses from test specimens of conveyor belting materials heated for 1 hour at 150° C., 200° C., 250° C., and 300° C., as amended to include weight losses occurring during 3-hour conditioning period at 105° C.

Material	Original sample weight, gms.	105° C. Gm.	105° C. Percent	150° C. 1/ Gm	150° C. 2/ Percent	200° C. 1/ Gm.	200° C. 2/ Percent	250° C. 1/ Gm	250° C. 2/ Percent	300° C. 1/ Gm.	300° C. 2/ Percent
Sample 1	2.1321	0.0388	1.82	0.0416	1.95						
Polyvinylchloride belting	2.1175	.0269	1.27			0.1313	6.20				
5-ply	2.1071	.0269	1.28					1.3009	61.74		
13/32 inch thick	2.0692	.0268	1.30							1.4293	69.08
Sample 2	2.3701	.0339	1.43	.0438	1.85						
Neoprene belting	2.3112	.0268	1.16			.0621	2.69				
4-ply	2.3080	.0273	1.18					.4992	21.63		
13/32 inch thick	2.3158	.0279	1.20							1.1048	47.71
Sample 3	2.2044	.0367	1.66	.0415	1.88						
Rubber belting	2.2304	.0252	1.13			.0529	2.37				
4-ply	2.1787	.0241	1.11					.3153	14.47		
15/32 inch thick	2.2301	.0250	1.12							.7819	35.06
Sample 4	2.5273	.0395	1.56	.0503	1.99						
Rubber belting	2.5450	.0297	1.17			.0553	2.17				
4-ply	2.5131	.0278	1.11					.4615	18.36		
17/32 inch thick	2.4790	.0279	1.13							1.2547	50.61
Sample 5	2.3651	.0385	1.63	.0427	1.81						
Rubber belting	2.5136	.0318	1.27			.0587	2.34				
4-ply	2.4572	.0299	1.22					.2840	11.56		
15/32 inch thick	2.4750	.0295	1.19							.5597	22.61
Sample 6	2.3440	.0642	2.74	.0731	3.12						
Rubber belting	2.3307	.0491	2.11			.0770	3.30				
7-ply	2.3499	.0496	2.11					.2779	11.83		
½ inch thick	2.3575	.0504	2.14							1.2823	54.39
Sample 7	2.5935	.0545	2.10	.0575	2.22						
Rubber belting	2.6780	.0544	2.03			.0950	3.55				
6-ply	2.6028	.0542	2.08					.3308	12.71		
17/32 inch thick	2.5383	.0515	2.03							1.2982	51.14

1/ Weight loss at indicated temperature plus weight loss during 3-hour conditioning at 105° C.
2/ Based on original sample weight.

TABLE 3.—Volume of gases evolved by thermal decomposition of fabricated belt materials
Bureau of Mines designation of materials by laboratory test number

	°C.	Rubber 8	Rubber 19	Rubber 45	Rubber 63	Neoprene 14	Neoprene 52	Neoprene 51	Neoprene 61	Pvc.2/ 40	Pvc.2/ 41	Pvc.2/ 67
CO_2,	200°	9.8	3.9	4.9	2.2	2.8	7.8	1.3	1.2	0.8	7.1	3.0
ml.1/ per	225°	....	....	11.7	9.4	....	....	4.6	4.3	....	....	10.9
gm. sample	250°	7.5	13.9	40.9	28.6	18.0	15.1	47.5	31.8	32.3	18.3	34.4
60° F., 30" Hg.	275°	....	....	96.8	65.0	....	....	60.6	39.3	....	....	47.9
	300°	127.5	36.4	182.5	90.7	71.8	68.3	83.0	52.7	68.4	41.7	70.4
CO,	200°	0.9	0.6	1.9	0.9	0.2	0.2	0.5	0.4	0.3	0.2	0.6
ml. per	225°	....	....	6.1	3.5	....	....	1.2	0.8	....	....	3.5
gm. sample	250°	4.8	7.3	20.9	14.0	2.9	3.7	18.9	15.6	16.0	7.5	17.4
60° F., 30" Hg.	275°	....	....	47.7	33.8	....	....	25.9	19.3	....	....	22.8
	300°	65.0	32.4	73.6	51.0	23.2	30.2	32.2	24.2	35.9	18.4	31.0
HCl,	200°	....	....	....	....	0.0	Trace	0.0	0.0	0.1	0.1	0.3
ml. per	225°	....	....	....	....	....	....	.9	.2	....	....	6.2
gm. sample	250°	....	....	....	....	.0	0.6	38.3	32.8	68.0	44.1	72.0
60° F., 30" Hg.	275°	....	....	....	....	....	....	37.8	41.6	....	....	81.3
	300°	....	....	....	....	4.7	42.8	36.0	47.9	76.8	78.3	81.1

1/ To convert milliliters (ml.) per (gm.) of sample to cubic feet per pound, multiply by the factor 0.016.
2/ Polyvinylchloride.

H. A. Cameron

Mr. H. A. Cameron is now Sales Manager for the Allegheny Machinery Co. Greentree Road, Pittsburgh, Pa. Mr. Cameron was formerly with the Beckwith Machinery Co. until his retirement last January after 35 years service his last position was General Sales Manager.

The Allegheny Machinery Co. handles the lines of the Link-Belt Speeder Co. the Pettibone-Mulliken Corp. the Gardner-Denver Co. The Mayhue Co. Quick-Way Shovel and Crane Co. and the Carter Pump Co.

Advertiser's Index

COAL MINING

October, 1955